Natural Resource Management
Training Program

College of Social and Behavioral Sciences
Department of Psychology

THE UNIVERSITY OF
ARIZONA ®

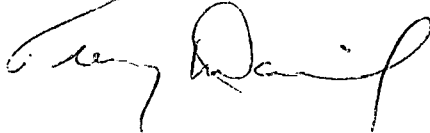TUCSON ARIZONA

PO Box 210068
Tucson, AZ 85721-0068

September 4, 1997

To: Bov Eav
Team Leader, FHTET

*Agreement #
28-C5-904 - Technology Training
Program for Nat. Resource & Environmental
Managers*

Re: Natural Resources Training Program: Final Report

From: Terry Daniel

The attached report completes the specified objectives of the referenced cooperative
agreement. I am submitting this report and attachments on behalf of the project Principal
Investigator, Gordon Lehman. Gordon retired from the University in July, but only after
having insured that the final work on this project would be completed. The final piece, the
record system/data base, was just completed, following the specifications that Gordon had
recorded before he left the University.

On his behalf, and on behalf of the School for Renewable Natural Resources, I wish to
express our appreciation for the support and cooperation of FHTET in this effort. I also
wish to assure you of the School's continuing interest in pursuing a program along the
lines of that prototyped in this report. We continue to strongly believe that a Forest
Service-University cooperative program in natural resource management training would
be of benefit to both the agency and the University—and especially to the trainees.

Natural Resource Management Training Program
Final Report

Cooperative Research Agreement

between

USDA Forest Service
Forest Health Protection
Forest Health Technology Enterprise Team

and

School for Renewable Natural Resources
University of Arizona
Tucson, Arizona 85721

submitted by

Gordon Lehman
Associate Professor
School for Renewable Natural Resources
Principal Investigator

Natural Resource Management Training Program
Final Report

The proposed (and to a limited extent tested) Forest Service-University of Arizona cooperative training program was designed to meet the continuing and growing need for environmental and natural resources management training. The need for such training, especially in the rapidly advancing areas of information technology, are widely recognized at all levels, from the directors to the managers to the individuals who must daily face an ever changing array of environmental management problems and management tools. The science and technology of natural resources management is advancing at a very rapid pace, far outstripping conventional educational systems—college courses and degrees in technical fields are often outdated in a few years.

The goals for and the obstacles to natural resource management are in a constant state of flux as social changes affect the definitions of "resources" and affect the acceptability of what were traditional management strategies. Re-organizations of government environmental agencies—an as yet unending process—has resulted in the loss of some key experienced personnel, and in the shuffling of many others into new positions that are often not closely related to their formal education or previous professional experience. All of these factors strongly indicate the need for a renewed commitment to personnel training, and possibly call for a new paradigm to make high quality, up-to-date training available on a sustained basis.

The motivation for the Natural Resource Management Training Program was the above cited increasing and continuing need for training for professional managers and resource specialists in the Forest Service and other land management agencies. The goals of the proposed program were to develop and test a sustainable training system providing a coordinated curriculum of quality assured training courses to meet the needs of government agencies, and to provide the trainees and their supervisors with a documented record of training accomplishments. The basic approach was to combine the technical problem-definition and objective specification capabilities of the Forest Service with the pedagogical and educational administrative capabilities of the University.

In this initial effort, two existing training courses developed and previously offered by units of the USDA Forest Service were reviewed by University of Arizona faculty. The goal was to obtain recommendations for changes to the material, presentation procedures and evaluation methods represented to bring the courses into compliance with standard University credit requirements. Both of the initial courses were reviewed and returned to the Forest Service trainers for suggested revisions. Both courses (assuming the recommended revisions) were submitted for review by the Continuing Education program at the University and both were provisionally approved for credit (see Attachments 1 and 2).

In addition, a performance evaluation and transcript record keeping system was devised and implemented on a prototype basis. The goals of this record keeping system were to provide the trainee with a secure and dependable personal record of training accomplishments, and to provide supervisors (or potential supervisors) with a documented record of the contents of training courses taken and of the trainee's performance in those courses (see Attachment 3). In the proposed program, trainees would have the options of 1) taking the course for University credit offered through the Continuing Education program, 2) taking the course for credit within the program (requiring specified levels of performance on course tests and evaluation exercises, resulting in grade of Superior, Pass or Unsatisfactory) or 3) participate in the training without evaluation (Audit).

As with all University transcripts, training course performance records would be the property of the trainee, and they would not be released except with the approval and at the expressed direction of the trainee. Transcripts would be maintained and serviced by the School for Renewable Natural Resources, University of Arizona for a period of 10 years following any training provided under the provisions of the program.

For reasons beyond the control of the cooperators in this pilot program, the two courses subjected to review were never in fact offered under the proposed program. Thus, this report and the attached materials are presented as a prototype of the system envisioned by the cooperators, and in the hope that something like the proposed program can be developed further at a later time.

ATTACHMENTS

1) Transmittal and summary of reviews for two training courses (majority of reviewer comments were recorded on the course materials and returned to the authors/trainers):
   a) *Digital Image Processing for Ecosystem Management*
   b) *Cartography for GIS Users;*

2) Copies of the course recommendation forms that subsequently resulted in the approval of both courses for University of Arizona Continuing Education credit (now expired);
3) Natural Resource Management Training Program Database—summary of trainee record keeping system (system on file at the School for Renewable Natural Resources).

OFFICE OF ARID LANDS STUDIES

ARIZONA REMOTE SENSING CENTER

MEMORANDUM

DATE: December 4, 1995

TO: Professor Gordon S. Lehman
                   Renewable Natural Resources
                   Biosciences East 319

FROM: Stuart E. Marsh

SUBJECT: Forest Service Training Materials

Dear Gordon:

As you and Chuck discussed, Doug Kliman spent a couple of days reviewing the two course books from the Forest Service and I have attached his evaluation of the materials. I have also spent a couple of hours looking at the materials and agree that the image processing course is very good but that the cartography course could use some improvement. We would be happy to discuss ways in which we might be able to participate in improving the Cartography for GIS Users course.

Please give me a call if there are any questions and if you would like to talk about this - Chuck will be out of town until December 15th.

Best Regards,

To: Charles F. Hutchinson/Stuart E. Marsh

From: Douglas H. Kliman

Date: 29 November 1995

Subject: USFS COURSE MATERIALS

I have reviewed the two course outlines as requested. Here are my general comments:

Digital Image Processing for Ecosystem Management: These course materials are some of the best treatments of the subject I have seen. The material is concise, well presented, and incorporates hands on and lectures. The pages are ready for use as overheads. I have only a few, very minor suggestions on areas which could be strengthened:

1. More discussion of applications and examples
2. Add a discussion of advanced techniques - Fourier, AI, etc. for discussion
3. Incorporation of photographs of equipment and imagery examples
4. Section on flight planning/aviation considerations would be useful

Cartography for GIS Users: The course materials are a good starting point, but need substantial reorganization and clarification. The course content is good, but it needs to be broken down into more coherent lessons. Each lesson should have a plan, objectives and a summary.   General concepts should be illustrated with specific examples - this order is reversed in several places. There is too much emphasis on terminology and definitions and too little on general concepts. More illustrations are needed - the course should be map intensive.   More discussion of types of maps and charts would be useful.   Subject matter needs to be more logically organized.   As it stands, administrative, graphic and technical topics are intermixed. These should be separated in discrete sections. In some cases, explanations draw on concepts which are presented later in the course materials.   An improved organization might look like this:

    A. Overview
    B. Geographic concepts
    C. Cartographic concepts
    D. Graphic design
    E. Computer graphics/GIS
    F. Application to specific USFS projects/standards

Graphics and page formatting needs to be addressed. If the pages are intended to be used as overheads, a number of them will need to be reformatted.   About 2/3rds of them have too much text, long sentences where bullet items would do, and are difficult to read . Clearer more concise overheads, with more graphics are needed.

With these improvements, I think it is possible to bring the course materials to the same high quality as the image processing course materials.

RECOMMENDATION FOR EXPERIMENTAL OR TEMPORARY COURSE

INSTRUCTIONS:
1. For first offering, complete form through section 9 and signatures. For successive offering(s), complete section(s) 10 (and 11) on copies of this form and resubmit.
2. Experimental/temporary course number must end in "x" (e.g., 406x (lecture), 596ax (proseminar), 695bx (colloquium))
3. Forms are forwarded from the department through the dean's office to the curriculum office. If course is crosslisted, head of cross-listing department must sign before form is received in the dean's office.

1. Renewable Natural Resources   2. RNR 297b x   3. Oct 2 1995
      Academic Dept. or Committee   Course Number   Date

4. /D/I/G/I/T/A/L/ /I/M/A/G/E/ /P/R/O/C/E/S/S/I/N/G/ /F/O/R/ /E/C/O/S/Y/S/T/E/M/ MANAGEMENT
      Course title (not to exceed 30 spaces) do not abbreviate

5. Available for graduate credit? __No__   To be available pass/fail

6. Credit hours __1__   Contact hours lecture weekly_____   Lab hours weekly_____   Workshop 40

7. Course description (or attach syllabus)

    Attached syllabus

8. Crosslisting department (if any) _____ None
    (Crosslisting department head must sign below.)

9. **FIRST OFFERING:** Semester _Spr_ Year _1996_   Is course to be held on campus or off? __Off__
      (If off campus, attach "Request for Off-Campus Offering" - green form)
    If course dates do not coincide with those of a regular term or summer session:
    Class will meet from __8 am__ to __5 pm__ on _MTWThF_ from _Mar 22_ through _Mar 27_
      (starting time)   (ending time)   (day of week)   (starting date)   (ending date)
    Instructor's name and title __George Ball, Asst Res Professor__
    If instructor is not a regular faculty member (listed in the general catalog), please attach a vita.

10. **NOTIFICATION OF SECOND OFFERING:** Semester _Spr_ Year _1996_   Is course to be held on campus or off? __Off__
      (If off campus, attach "Request for Off-Campus Offering" - green form)
    If course dates do not coincide with those of a regular term or summer session:
    Class will meet from __8 am__ to __5 pm__ on _MTWThF_ from _Apr 1_ through __Apr 5__
      (starting time)   (ending time)   (day of week)   (starting date)   (ending date)
    Instructor's name and title __George Ball, Asst Res Professor__
    If instructor is not a regular faculty member (listed in the general catalog), please attach a vita.

11. **NOTIFICATION OF SUBSEQUENT OFFERINGS, IF ANY** (Course may be offered more than twice only if all offerings occur within one calendar year.)
    Semester _____ Year _____   Is course to be held on campus or off? _____
    If course dates do not coincide with those of a regular term or summer session:
    Class will meet from_____to _____ on _____ from _____ through _____
      (starting time)   (ending time)   (day of week)   (starting date)   (ending date)
    Instructor's name and title _____
    If instructor is not a regular faculty member (listed in the general catalog), please attach a vita.

SIGNATURES	FOR CURRICULUM OFFICE USE ONLY
Department Head	
Head of Crosslisting Department	

DIGITAL IMAGE PROCESSING FOR ECOSYSTEM MANAGEMENT

RNR 297b (one credit through Extended University)

OBJECTIVES: Update the knowledge and skills of Forest Service personnel in digital image processing as applied to ecosystem management.

FORMAT: This one-week-long workshop will cover the subject through the use of lectures and considerable hands-on experience in digital image processing.

EVALUATION: Participants will be evaluated by their work on a series of projects and problems throughout the workshop and by other appropriate assessment methods.

GRADING: Participants in the workshop may elect to attend with or without receiving University credit for their work. Those electing credit will participate through Extended University. The course will be available for letter grade, pass/fail, or audit as selected by the participant.

ENROLLMENT: Enrollment in the workshop will be limited to 26 people of which we anticipate 4 to 6 participants may elect to register for University credit.

SUBJECT MATTER: Topics to be included in the workshop are:

Brief History of Remote Sensing
Electromagnetic Energy & the Electromagnetic Spectrum
Resolution Concepts
Common Sensors and their Characteristics
Data Structure (Raster & Vector)
Image Processing
Vegetation Feature Enhancement
Principal Components Analysis
Image Classification
Postprocessing
Accuracy Assessment
Project Planning

Exercises:
Intro of Digital Image Data into IDRISI
Image Display, Sketches and Saturations
Scalar Operations for Dark Object Subtraction
Image to Image Registration
NDVI (vegetation indices)
Principal Components Analysis of Data Sets
Unsupervised Classification of Quad
Supervised Classification of Quad
Filtering of Quad Cover Type Layer
Accuracy Assessment of Quad

REFERENCE MATERIAL: Digital Image Processing for Ecosystem Management

This instruction manual was prepared by training personnel of the Nationwide Forestry Applications Program, USDA -- Forest Service, Salt Lake City, Utah, specifically for this course. The manual was modified to include material deemed important by University of Arizona reviewers. The manual was reviewed by George Ball (SRNR) and Chuck Hutchinson (Arid Lands).

INSTRUCTORS: The workshop will be taught by USDA -- Forest Service Training personnel and by contracted experts in digital image processing and remote sensing.

RECOMMENDATION FOR EXPERIMENTAL OR TEMPORARY COURSE

INSTRUCTIONS:
1. For first offering, complete form through section 9 and signatures. For successive offering(s), complete section(s) 10 (and 11) on copies of this form and resubmit.
2. Experimental/temporary course number must end in "x"; e.g., 406x (lecture), 396ax (proseminar), 695bx (colloquium).
3. Forms are forwarded from the department through the dean's office to the curriculum office. If course is crosslisted, head of cross-listing department must sign before form is received in the dean's office.

1. __Renewable Natural Resources__   2. __RNR 297a x__   3. __Oct. 2, 1995__
   Academic Dept. or Committee   Course Number   Date

4. |C/A/R/T/O/G/R/A/P/H/Y/ /F/O/R/ /G/I/S/ /U/S/E/R/S/ / / / / |
   Course title (not to exceed 30 spaces); do not abbreviate.

5. Available for graduate credit? ___NO___   To be available/pass/fail

6. Credit hours ___1___   Contact hours lecture weekly _____ Lab hours weekly _____ Workshop 40

7. Course description (or attach syllabus)

   Attached syllabus

8. Crosslisting department (if any) _____None_____
   (Crosslisting department head must sign below.)

9. FIRST OFFERING: Semester __SPR__ Year __1996__ Is course to be held on campus or off? __OFF__
   (If off campus, attach "Request for Off-Campus Offering" - green form)

   If course dates do not coincide with those of a regular term or summer session:

   Class will meet from __8 am__ to __5 pm__ on __MTWThF__ from __MAR 22__ through __MAR 29__.
                    (starting time) (ending time) (day of week) (starting date)   (ending date)

   Instructor's name and title __Gordon Lehman, Assoc. Prof.__
   If instructor is not a regular faculty member (listed in the general catalog), please attach a vita.

10. NOTIFICATION OF SECOND OFFERING: Semester __SPR__ Year __1996__ Is course to be held on campus or off? __Off__
    (If off campus, attach "Request for Off-Campus Offering" - green form)

    If course dates do not coincide with those of a regular term or summer session:

    Class will meet from __8am__ to __5pm__ on __MTWThF__ from __APR 1__ through __APR 5__.
                     (starting time) (ending time) (day of week) (starting date)   (ending date)
    Instructor's name and title __Gordon S. Lehman, Assoc. Professor__
    If instructor is not a regular faculty member (listed in the general catalog), please attach a vita.

11. NOTIFICATION OF SUBSEQUENT OFFERINGS, IF ANY (Course may be offered more than twice only if all offerings occur within one calendar year.)

    Semester _____ Year _____ Is course to be held on campus or off? _____

    If course dates do not coincide with those of a regular term or summer session:

    Class will meet from_____ to _____on _____from _____through _____.
                     (starting time) (ending time) (day of week) (starting date)   (ending date)

    Instructor's name and title _____
    If instructor is not a regular faculty member (listed in the general catalog), please attach a vita.

SIGNATURES   FOR CURRICULUM OFFICE USE ONLY --

Department Head

Head of Crosslisting Department

CARTOGRAPHY FOR GIS USERS

RNR 297a (one credit through Extended University)

OBJECTIVES: Update the knowledge and skills of Forest Service personnel in cartography and its application in geographic information systems.

FORMAT: This one-week-long workshop will cover the subject through the use of lectures and considerable hands-on experience of the cartographic process including use of computers for applying cartographic principles to GIS.

EVALUATION: Participants will be evaluated by their work on a series of projects and problems throughout the workshop and by other appropriate assessment methods.

GRADING: Participants in the workshop may elect to attend with or without receiving University credit For their work. Those electing credit will participate through Extend University. The course will be available for letter grade, pass/fail, or audit as selected by the participant.

ENROLLMENT: Enrollment in the workshop will be limited to 26 people of which we anticipate 4 to 6 participants may elect to register for University credit.

SUBJECT MATTER: Topics to be included in the workshop are:

Fundamental Concepts of Cartography
Cartography as a Science
The Earth
Projections and Scales
Plane Coordinate Systems
Land Positioning Systems
Accuracy and Source Data
Generalizations
Designing the Map
Color and Pattern
Topography
Geographic Data
Symbolization
Mapping and Land Surface Forms
Mapping with GIS
Type Placement
US Forest Service Mapping Specifications

Final Exercise
Final Map Composition

REFERENCE MATERIAL: Cartography for GIS Users
The instruction manual was prepared by training personnel of the USDA -- Forest Service specifically for this course. The manual is being modified to include additional material deemed important by University of Arizona reviewers. The manual was reviewed by

George Ball and Gordon Lehman (SRNR) and by Chuck Hutchinson and Stuart Marsh (Arid Lands).

INSTRUCTORS: This workshop will be taught by USDA -- Forest Service Training Staff personnel expert in cartography and by contracted experts in cartography.

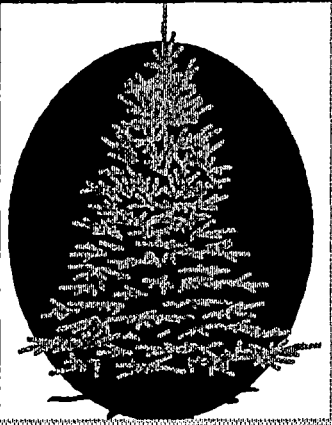# NATURAL RESOURCE MANAGEMENT TRAINING PROGRAM DATABASE

This database maintains records on courses, students, and instructors for the training program. It produces the following outputs:

1. Class Enrollment List- for instructor's use
2. Class Grade List- for instructor's use
3. Student Grade Reports- for mailing to students. Grade reports for all students in the class are printed by entering the course number and date. Grade report is designed so that student name and address will appear in plastic window of envelope.
4. Student Transcript- can be retrieved by student's name or ID number. This is also designed so that name and address will appear in an envelope's plastic window.
5. Course Summary and Statement of Learning Objectives- to be sent with transcript.

An example of each output is attached. A print out of the menus and some of the data entry forms are also included.

RTI

Natural Resource Management Training Program

Enter/View Data Forms

Print/Preview Reports

Database Window

Exit Microsoft Access

RTI

Natural Resource Management Training Program

Enter or View Data Forms

Student Information | Course Information

Enroll Students | Course Description

Enter Grades | Instructor Information

New Course- Credits

Courses Submitted for UA Credit

Courses Under Review

Return to Main Menu

RTI

Natural Resource Management Training Program

REPORTS

Preview	Class Enrollment List	Print
Preview	Class Grade List	Print
Preview	Grade Reports	Print
Preview	Course Description	Print
Preview	Student Transcript	Print

Return to Main Menu

Course Number   RTI-6789

Course Name   Management of Livestock & Riparian Areas

Approved for UA credit?   Yes   **Approved for Continuing Education Units?**   Yes

UA credits   2   **CE Units**   2   **Contact Hours**   20

Instructor Information Form

Instructor ID [9]

Course # [RTI-2345]   Beginning Date [3/1/97]

Instructor SSN [111-00-2222]   Address [5674 Elm St]

[ ]

First Name [Douglas]   City [Pinetop]

Last Name [Fir]   State [AZ]   Postal Code [85729]

Country [ ]

Employer [UDSA Forest Service]   Work Phone [(602) 256-6035]

Course Information Form

Course # RTI-1000   Course Name GIS

Beginning Date 10/1/96   Course Location Tucson, AZ

Ending Date 10/5/96

Primary Instructor Guertin, Phil

Co-instructor 1

Co-instructor 2

ENTRY REQUIRED:

Course
Description

Enter Student Grades Form

Course # | RTI-1234 | **Beginning Date** | 7/1/96

Primary Instructor   Bunyan, Paul

Enter Grades:

StudentSSN	Student Name	TCgrade	UAcredit?	UAgrade
777-88-9999	Appleseed, Johnny	U	No	
000-12-3456	Ditty, Nizhoni L	S	No	
666-66-6666	Goodrich, Michael	S	No	
555-55-5555	Leno, Jay	P	No	
303-03-0303	Thomas, Jack Ward	S	No	

NATURAL RESOURCE MANAGEMENT TRAINING PROGRAM

Resource Technology Institute

Class Enrollment List

Course Number: RTI-1234   **Dates:** 7/1/96-7/5/96

Course Name: Integrated Forest Vegetation Management

Primary Instructor: Bunyan, Paul   **Course Location:** Flagstaff, AZ

Student SSN	Student Name	Taking for CE credit?	Taking for UA credit?*
777-88-9999	Appleseed, Johnny	Yes	No
000-12-3456	Ditty, Nizhoni	Yes	No
666-66-6666	Goodrich, Michael	No	No
555-55-5555	Leno, Jay	No	No
303-03-0303	Thomas, Jack Ward	No	No

*Is Course Offered for UA credit?   No

Total Enrollment: 5   RTI-1234   7/1/96-7/5/96

Tuesday, August 26, 1997

NATURAL RESOURCE MANAGEMENT TRAINING PROGRAM

RESOURCE TECHNOLOGY INSTITUTE

Class Grade List

Course Number: RTI-5432   **Dates:** 8/2/96-8/6/96

Course Name: Bat Workshop

Primary Instructor: Plecotus, Mary   **Course Location:** Portal, AZ

Student SSN	Student Name	TC grade	UA grade
777-88-9999	Appleseed, Johnny	P	C
000-12-3456	Ditty, Nizhoni	S	
512-48-5554	Norris, Leslie Gail	S	

NATURAL RESOURCE MANAGEMENT TRAINING PROGRAM
RESOURCE TECHNOLOGY INSTITUTE

SCHOOL OF RENEWABLE NATURAL RESOURCES
UNIVERSITY OF ARIZONA
TUCSON, ARIZONA

GRADE REPORT OF: Appleseed, Johnny   **SSN:** 777-88-9999
Orchard Ave
Apt. C
Fruitville   OR
                        40385

Dates	Course#	Course Name	Grade
7/1/96-7/5/96	RTI-1234	Integrated Forest Vegetation Management	U

TRAINING COURSE GRADE CODES

S/Superior- superior competency and mastery of the material presented

P/Pass- average level of competency and knowledge of material

U/Unsatisfactory- little demonstrated competency or knowledge of material

Students taking course for University of Arizona credit will receive a separate grade report

NATURAL RESOURCE MANAGEMENT TRAINING PROGRAM
RESOURCE TECHNOLOGY INSTITUTE

SCHOOL OF RENEWABLE NATURAL RESOURCES
UNIVERSITY OF ARIZONA
TUCSON, ARIZONA

OFFICIAL TRANSCRIPT OF: Nizhoni L Ditty
4356 E 2nd
Tucson, AZ
85711

SSN: 000-12-3456

Dates	Course #	Course Name	Grade*	Credit?^
7/1/96-7/5/96	RTI-1234	Integrated Forest Vegetation Management	S	Yes
8/2/96-8/6/96	RTI-5432	Bat Workshop	S	Yes

Official Seal

Certifying Official
School of Renewable Natural Resources
University of Arizona

_____
Signature and Title

A detailed course description is appended to this transcript

*Grading system employed: S/Superior- indicates superior competency and mastery of the material presented
P/Pass- indicates an average level of competency and knowledge of the material
U/Unsatisfactory- indicates little demonstrated competency or knowledge of the material

^ Course was also completed for Continuing Education Credit

NATURAL RESOURCE MANAGEMENT TRAINING PROGRAM

RESOURCE TECHNOLOGY INSTITUTE

SCHOOL OF RENEWABLE NATURAL RESOURCES
UNIVERSITY OF ARIZONA
TUCSON, ARIZONA

Course Summary and Learning Objectives

RTI-2345   3/1/96-3/5/96   Forest Health Management for Nurseries

This is a summary of the course and a statement of learning objectives. A description of each course on a student's transcript will be attached to the transcript. The description will match the year the course was taken in the event that the description is revised from year to year.